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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
OPP030280KR		
International application No.	International filing date (*day/month/year*)	Priority Date (*day/month/year*)
PCT/KR 2003/000883	2 May 2003 (02.05.2003)	8 August 2002 (08.08.2002)
International Patent Classification (IPC) or national classification and IPC		
IPC^7: C07C 63/38, C07C 51/265		
Applicant		
SK CHEMICALS CO., LTD		

1. This international preliminary examination report has been prepared by this International Preliminary Examination Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I. ☒ Basis of the opinion
   - II. ☐ Priority
   - III. ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV. ☐ Lack of unity of invention
   - V. ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI. ☐ Certain documents cited
   - VII. ☐ Certain defects in the international application
   - VIII. ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
27.02.2004	3 February 2005 (03.02.2005)
Name and mailing address of the IPEA/AT Austrian Patent Office Dresdner Straße 87 A-1200 Vienna Facsimile No. 1/53424/200	Authorized officer MÜLLER-HIEL R. Telephone No. 1/53424/225

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/KR 2003/000883

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed

☒ the description:
pages 1-22, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____.

☒ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under Article 19
pages _____, filed with the demand
pages 23, 24, filed with the letter of 5 July 2004 (05.07.2004).

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____.

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____.

☐ the claims, Nos. _____.

☐ the drawings, sheets/fig _____.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as „originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/KR 2003/000883

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	6, 7	YES
	Claims	1-5	NO
Inventive step (IS)	Claims	----	YES
	Claims	1-7	NO
Industrial applicability (IA)	Claims	1-7	YES
	Claims	----	NO

Citations and explanations (Rule 70.7)

The following documents have been cited in the Search Report:

D1: WO 1999/018059 A1
D2: WO 2003/022791 A1
D3: US 5183933 A1
D4: US 4950786 A1
D5: JP 06 279356 A2

Document D1 describes a process for the oxidation of 2,6-dimethylnaphthalene to 2,6-naphthalenedicarboylic acid using cobalt, manganese and bromine as catalysts and acetic acid as solvent. The same reaction temperature as claimed in claim 1 of the present application is already described in claim 4 and on page 5 of document D1.

In claims 2 and 3 of document D1 the same concentration of the metal catalysts in acetic acid is described as it is claimed in claim 3 of the present application.

The ratio of 1: 0,5 of cobalt and manganese is already described in line 24 on page 4 of document D1. Moreover it is indicated in document D1 that for the purity of the desired product it would be advantageous to use more cobalt. The high amount of manganese was only used, because manganese is cheaper than cobalt.

The molar ratio of bromine to the metal catalysts as claimed in claim 5 of the present application is already described on page 5, lines 3-5 of document D1.

On page 6, lines 4 and 5 of document D1 the proposed reaction time is identical to the reaction time as claimed in claim 6 of the present application.

Amended claim 1 is further characterized by the addition of nitrogen or off-gas to to the reactor. As this feature is not mentioned in D1, amened claim 1 and the dependent claims 2-7 have to be acknowledged as novel in view of D1.

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box V (page 1)

Documents D3 and D4 were cited in the search report to illustrate that the parameters of the process claimed in the present application are already well known state of the art, even if each of the documents D3 and D4 do not contain all parameters as claimed in the present application.

With respect to D5, the applicant pointed out in his response to the Written Opinion, that the oxygen of D5 is pure O2 gas, in contrast to the utilization of air according to the application. Reinvestigation of D5 revealed that the process according to D5 is also performed with AIR and nitrogen. (JP 06-279356: paragraph [0010], examples 1,2 ; Chem. Abstr. 122 :80901). According to D5, the process comprises the conversion of 2,6-dimethylnaphthalene to 2,6-naphthalene-dicarboxylic acid by a catalytic reaction in acetic acid under nitrogen and air, the catalyst containing Co, Mn and Br, at a temperature of 150-220 deg.C. Therefore, claims 1 and 2 of the application cannot be considered to meet the requirements of novelty and inventive step.

According to the examples given in D5, the concentration of the metal catalysts of cobalt and manganese in acetic acid , the molar ratio of the metal catalysts of cobalt and manganese, and the molar ratio of bromine to the metal catalysts of cobalt and manganese are within the ranges as defined in claims 3-5, respectively.
Therefore, claims 3-5 of the application cannot be considered to meet the requirements of novelty and inventive step.

The reaction time according to D5 is 2+1 hours. No explicit information could be retrieved from D5 concerning the weight ratio of DMN to air. Therefore, claims 6 and 7 are acknowledged as novel over the prior art.

The reaction time according to D1 (page 6, lines 4 and 5) is identical to the reaction time as described in claim 6. Therefore, in view of documents D1 and D5, claim 6 does not fulfill the requirements of inventive step.

Variations of a parameter as defined in amended claim 7 are regarded as routine measures for a person skilled in the art. Therefore, amended claim 7 is not acknowledged involving an inventive step.

The use of nitrogen for the regulation of the oxygen content in the reaction gases is also known from D2 (claims 11,12), which document was published prior to the filing date but later than the priority date of the application. The consideration of this document would not change the result of this examination report.

Industrial applicability is obvious.

WHAT IS CLAIMED IS:

1. **(Amended)** A method for the preparation of naphthalene dicarboxylic acid by oxidizing dimethylnaphthalene with oxygen in air in the presence of acetic acid solvent using the metal catalysts of cobalt and manganese, and using bromine as a reaction initiator,

wherein said oxidizing reaction is carried out in the range of 155 to 180 ℃ with adding a gas selected from the group of nitrogen gas, off-gas and a mixture thereof into upper portion of a reactor, which the off-gas has oxygen with low concentration by pre-oxidation.

2. The method for the preparation of naphthalene dicarboxylic acid of claim 1, wherein said naphthalene dicarboxylic acid is 2,6-naphthalene dicarboxylic acid.

3. The method for the preparation of naphthalene dicarboxylic acid of claim 1, wherein the concentration of said metal catalysts of cobalt and manganese is 1000 ppm to 6000 ppm in acetic acid.

4. The method for the preparation of naphthalene dicarboxylic acid of claim 1, wherein the molar ratio of said metal catalysts of cobalt and manganese is 2:1 to 25:1.

5. The method for the preparation of naphthalene dicarboxylic acid of claim 1, wherein the molar ratio of said bromine to the metal catalysts of

cobalt and manganese is 0.1:1 to 0.8:1.

6. The method for the preparation of naphthalene dicarboxylic acid of claim 1, wherein the residence time of said acetic acid and the produced naphthalene dicarboxylic acid in the reactor is 30 to 120 min.

7. **(Amended)** The method for the preparation of naphthalene dicarboxylic acid of claim 1, wherein the weight ratio of said air to dimethylnaphthalene is 4:1 to 15:1.